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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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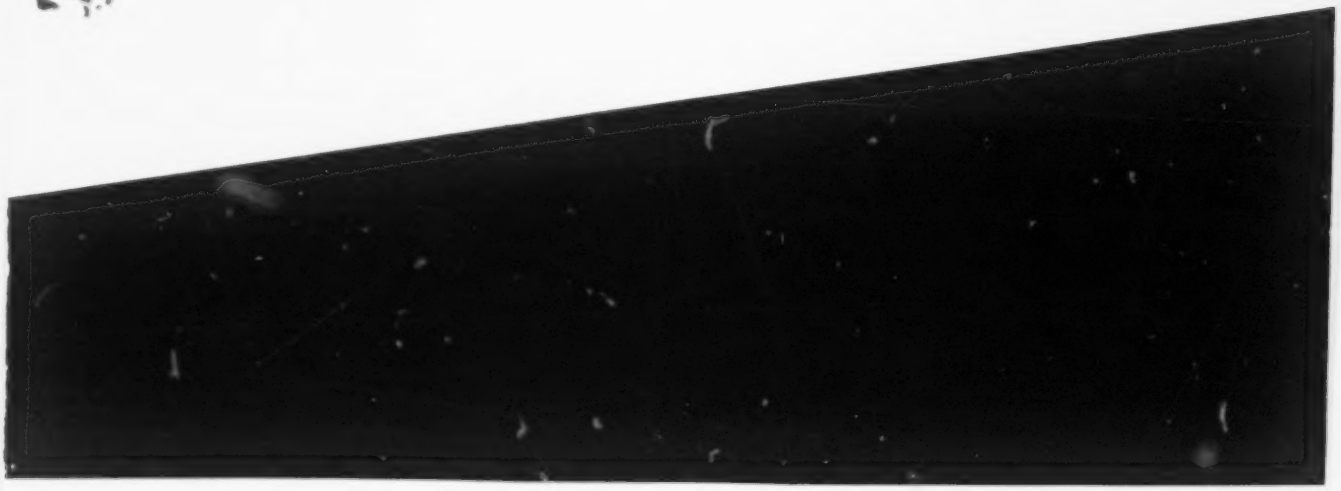
Development of USES Aptitude Test Battery

for

Assembler, Microwave Tube

(electronics) 725.884



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Technical Report on Development of USES Test Battery

For .....

Assembler, Microwave Tube (electronics) ~~690.885~~ 725.884

S-392

U. S. Employment Service
in cooperation with
California State Employment Service

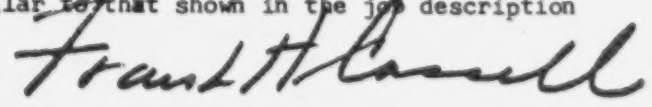
February 1967

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.



Frank H. Cassell, Director
U. S. Employment Service

GATB Study #2640

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Assembler, Microwave Tube (electronics) ~~690.885~~ 725.887
S-392

This report describes research undertaken for the purpose of determining General Aptitude Test Battery (GATB) norms for the occupation of Assembler, Microwave Tube (electronics) ~~692.885~~. 725.884
The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
G - General Learning Ability	75
K - Motor Coordination	100
F - Finger Dexterity	90
M - Manual Dexterity	80

RESEARCH SUMMARY

Sample:

60 employed workers (21 men and 49 women) employed as Microwave Tube Assembler in Palo Alto, California.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .49 (P/2 less than .0005)

Effectiveness of Norms:

Only 63% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 74% would have been good workers. 37% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 26% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	63%	74%
Poor Workers	37%	26%

SAMPLE DESCRIPTION

Size:

N = 60

Occupational Status:

Employed workers.

Work Setting:

Workers were employed by Varian Associates, Palo Alto, California.

Employer Selection Requirements:

Education:
SRW English. High school education preferred.
Previous Experience:
None. Previous electronics experience or an interest in bench crafts is preferred.
Tests:
None.
Other:
Personal interview to find highly motivated individuals with a good work record who appear to be a reasonable risk for long-term employment.

Principal Activities:

The job duties for each worker in the final sample are comparable to those in the job description in the Appendix.

Minimum Experience:

All workers in the sample had a minimum of three months experience. Although some workers require up to five months to attain job proficiency, none were included in the sample who were still considered to be in trainee status.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	39.0	10.1	19-58	-.029
Education (years)	11.5	1.4	8-14	-.041
Experience (months)	68.6	53.4	3-184	.282*

*Significant at the .05 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered in January 1966.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. Ratings and reratings, obtained at least two weeks later, were made by the immediate supervisor of each worker.

Rating Scale:

Form SP-21, "Descriptive Rating Scale", was used. The scale (see appendix) consisted of nine items covering different aspects of job performance. Each item had five alternatives corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .62 was obtained between the initial ratings and reratings, indicating a significant relationship. The final criterion score consisted of the combined scores of the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	40-90
Mean:	67.0
Standard Deviation:	12.7

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 37% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score was 61.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude G which does not have a significant correlation with the criterion was considered for inclusion in the norms because the qualitative analysis indicated that it was important for the job duties, and the sample had a relatively low standard deviation on this aptitude. With employed workers, a relatively low standard deviation indicates that some pre-selection may have taken place and this restricted range of scores (low standard deviation) will depress the correlation between the aptitude and the criterion. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Necessary for understanding verbal and written instructions.
P - Form Perception	Necessary for observing pertinent detail of components, parts and sub-assemblies in inspecting for conformance to standards.
K - Motor Coordination	Necessary for precise positioning of tube parts in jigs or machines.
F - Finger Dexterity	Necessary for manipulating small tools accurately in positioning and connecting operations.
M - Manual Dexterity	Necessary for using hand tools in finishing, painting, installing hardware and for wrapping insulation materials around tubes.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Aptitude	Mean	SD	Range	r
G - General Learning Ability	93.0	14.3	63-122	.111
V - Verbal Aptitude	95.8	12.5	74-131	-.049
N - Numerical Aptitude	90.4	16.4	61-129	.234
S - Spatial Aptitude	98.4	16.6	65-137	.125
P - Form Perception	107.9	19.2	67-162	.210
Q - Clerical Perception	109.9	13.6	72-144	.301*
K - Motor Coordination	112.2	15.8	64-142	.288*
F - Finger Dexterity	103.8	17.9	59-147	.362**
M - Manual Dexterity	113.1	21.1	73-164	.260*

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X				X		X	X	X
Irrelevant									
Relatively High Mean						X	X		X
Relatively Low SD	X	X				X			
Significant Correlation with Criterion						X	X	X	X
Aptitudes to be Considered for Trial Norms	G					Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of Aptitudes G, Q, K, F and M at trial cutting scores were able to differentiate between 63% of the sample considered good workers and 37% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of G-75, K-100, F-90 and M-80 provided the highest degree of differentiation. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .494 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms, G-75, K-100, F-90 and M-80

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	28	38
Poor Workers	17	5	22
Total	27	33	60

Phi Coefficient (Ø)= .49 Chi Square (X^2) = 14.62
Significance Level = P/2<.0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-18 which is shown in Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .28 is obtained with minimum aptitude norms of G-80, K-90 and M-80.

SP-21
Rev. 2/61

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and <u>only</u> these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

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FACT SHEET

Job Title: Assembler, Microwave Tube (electronics) 725.884

Job Summary: Assembles, inspects and tests microwave tubes, components, subassemblies and parts according to specifications using equipment such as spot welder, frequency meter, oscillograph, sealing machine, lapping machine and small hand tools.

Work Performed: Assembles and processes a variety of components and subassemblies to build tube parts: Receives verbal instructions and such written and graphic instructions as operation sheets, simple diagrams and samples. Examines instructions to determine assignment, materials, tools to use, sequence of operations, quantity ordered and required dimensions of product. Dons finger cots or nylon gloves, when applicable, to avoid contaminating product with body oils. Selects and positions appropriate aligning jig at convenient angle under binocular microscope or magnifying lens when working with subminiature parts preparatory to assembly operation. From bins located at work station selects and picks up designated components and subassemblies, such as miniature metal rods and wires, metal shields, lead wires, brazing rings, heaters, cathode stems, reflectors, tuners, grids and drift tubes, using hands, tweezers or long-nosed pliers; positions, aligns and stacks selected items into jig in specified sequence to assemble tube parts for oven-brazing. Compares items assembled in jig with instructions to verify specified assembly sequence; measures alignment of items using micrometer and caliper to assure conformance to specifications. Using pliers, tightens bolts on jig to hold assembled items firmly in place; places jig into designated brazing-oven container using hands, tweezers or long-nosed pliers. Visually examines designated brazed tube parts, using magnifying lens when applicable, to assure conformance to brazing specifications. Cleans particles of dirt, carbon and excess brazing material from tube parts, according to instruction, using vacuum pick-up. Connects designated tube parts together to form required circuitry by welding and soldering lead wires and filaments to specified contact points, using spot-welder and soldering iron. Measures concentricity and parallelism of welded and soldered units, using precision measuring instruments such as height gauges, dial indicators and shadowgraph, to assure conformance to specifications. Sets manual dials and gauges on frequency meter and oscillograph, according to instruction, preparatory to measuring tube frequency for conformance to specifications. Inserts designated tube part into socket of frequency meter and oscillograph by hand; compares frequency reading on frequency meter indicator and graph with specifications. Places tube parts meeting specifications into designated containers and places rejects into reject containers. Occasionally applies coating of metalized paint to designated components, according to specifications, using jeweler's lathe and paint brush or hand squeegee, to form brazing surface on components.

Seals parts to form tube: Sets and adjusts sealing machine manual controls such as temperature gauges, flow meters and timer, according to instruction; places designated tube parts on specified fixtures in machine, using hands, tweezers or long-nosed pliers, preparatory to automatic sealing operation that forms tube. Starts sealing machine by pressing manual start button to heat tube parts to prescribed temperature. The heat melts sealing material to form vacuum envelope (window) between parts and fuses designated tube parts. Observes sealing process to assure conformance with specifications; readjusts gauges and controls, as necessary, to attain specified seal. Removes tubes at end of sealing operation using hand, tweezers or long-nosed pliers; places tubes into containers for delivery to next work station.

Performs a variety of finishing operations on tube: Attaches designated accessories to tube according to instruction, such as manual tuning mechanism, tuner shaft and leads, using soldering iron, spot welder, tweezers and long-nosed pliers. Wraps silastic compound around designated parts of tube by hand to form protective insulation; places wrapped tube into pre-heated oven for specified length of time to cure insulation material. Tapes designated areas of tube with masking tape according to instruction; places tube into specified jig, preparatory to delivery to spray-painting booth. After painting operation, unwraps masking tape from tubes; cleans excess paint and particles of dirt from tube using solvent, pipe cleaners, scalpel and air gun as needed. Visually inspects tube for painting defects according to instruction; when necessary, touches up paint using small paint brush. Installs hardware on tube, such as nuts, bolts and screws, according to instruction, using manual and pneumatic wrenches and screwdrivers. Polishes and smoothes tube, as specified, using lapping machine and buffer. Stamps identification number on designated part of tube using hammer and steel marking die. Positions adhesive-backed identification decals on tube, as specified; smooths out air bubbles using small roller.

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February 1967 S-392

FACT SHEET

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